

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
REGION VIII

FINAL REPORT OF MINOR COAL OUTBURST DISASTER
NO. 2 MINE
UNITED STATES STEEL COMPANY, COAL DIVISION
GARY, McDOWELL COUNTY, WEST VIRGINIA

February 9, 1953

By

T. C. Higgins
W. E. Gaylor
J. L. Gilley
Coal-Mine Inspectors

Edward M. Thomas
Chief, Roof-Control Section

Originating Office - Bureau of Mines
Mount Hope, West Virginia
E. E. Quenon, Chief, Mount Hope Branch
Accident Prevention and Health Division

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INTRODUCTION

A coal outburst, or bump, which resulted in two fatalities and slight injuries to two other persons, occurred about 8:40 p.m., Monday, February 9, 1953, in the No. 2 mine, United States Steel Company, Coal Division, Gary, McDowell County, West Virginia. The other nine men in the affected area escaped uninjured. The names of the deceased and injured persons are listed in Appendix A of this report.

The rescue work led by company officials was completed within two hours after the outburst occurred.

GENERAL INFORMATION

The No. 2 mine is at Gary, McDowell County, West Virginia, and is served by the Norfolk and Western Railway. The mine is owned and operated by the United States Steel Company, Coal Division.

The names and addresses of the principal officials are as follows:

K. L. Konnerth	Vice President	Post Office Box 326 Pittsburgh 30, Pennsylvania
G. H. Sambrook	Safety Director	Post Office Box 326 Pittsburgh 30, Pennsylvania
W. R. Stedman	General Superintendent	Gary, West Virginia
C. R. Pringle	Superintendent	Gary, West Virginia
Perry Mosley	Mine Foreman	Gary, West Virginia

The mine was opened by seven drifts and four shafts into the low-volatile bituminous Pocahontas No. 4 coal bed, which averaged 80 inches in thickness in this locality. Two of the shafts were 74 feet in depth and the others were 80 and 150 feet in depth. The coal dust is

explosive and four gas ignitions have occurred in this mine resulting in three fatalities and several men being burned. Several coal outbursts have occurred in this mine previously, some of which have resulted in fatalities and serious injuries. Coal outbursts resulting in fatalities have also occurred in other mines working the same coal bed in this vicinity. A total of 830 men was employed, of which number 704 worked underground on three shifts a day, five days a week. The average daily production was 7,000 tons of coal, all of which was loaded mechanically. About 60 percent of the coal was loaded into mine cars and the remainder was loaded into cable-reel shuttle cars. Production for the year 1952 was 1,280,772 tons of coal. The last Federal inspection was completed on September 8, 1952.

Localized dispositional changes in the immediate roof structure ranging from sandstone to shale from one to four feet thick are encountered in the recovery heading territory; however, sandstone generally contacted the coal bed throughout the area involved in the outburst. The immediate roof over the affected area is comprised of a strong sandstone, reported to range from 6 to 18 feet in thickness, overlain by as much as 6 feet of shaly sandstone with lenticular coal formations, which in turn is overlain by a stratum of gray massive fine-grained sandstone ranging from 37 to 135 feet or more in thickness. This roof is of fine-grained sandstone, which is distinctive in that it has extraordinary tensile and compressive strength. Cleavage planes are virtually nonexistent in this structure. The topography of the terrain is rugged on this property and some of the higher mountains reach 2,300 feet in elevation and some of the mountains exceed 700 feet in relief. The maximum cover over the present mining in the affected area according to information obtained from the company's engineer is 1,260 feet.

The floor in the affected area is a dense, loosely consolidated sandy shale and shaly sandstone about 5 feet thick, which approaches sandstone in compressive strength but being loosely consolidated will heave readily when loaded beyond its yield point.

MINING METHODS, CONDITIONS, AND EQUIPMENT

Mining Methods. The mine was developed by a room-and-pillar method. Main entries were driven in sets of four to ten and room entries were driven in sets of four. The room entries were turned at 300-foot intervals off the main entries. Entries were turned on 75-foot centers and driven 13 to 16 feet in width. Rooms were turned on 45-foot centers; rooms and pockets in pillars were driven about 20 feet wide. Pillars were extracted by the open-end and pocket method on retreat. The coal was centercut and sheared by track-mounted and rubber-tire-mounted mining machines.

A systematic method of timbering was adopted. The method requires posts, cross bars, or cribs to be set on 4-foot centers to within 4 feet of the faces and two temporary safety posts to be set in by the permanent posts. The timbering plan prohibits employees working in by roof supports.

Roof bolts, 48 inches in length, 1 inch in diameter, on 4-foot centers, installed vertically with 6- by 6- by 3/8-inch bearing plates were used. Roof bolting in the section involved in the outburst was confined to entry roadways and intersections. It is believed that the roof at the intersection of the room in which the outburst occurred would have collapsed if bolts had not been used to support the roof at this location. The bolting method of roof support was utilized to advantage in development and retreat mining in the 19 and 20 left sections of recovery headings, as well as in other areas of this mine for 2 years or more.

Explosives. Properly constructed magazines were provided on the surface for the storage of explosives and detonators, and the daily supply was transported underground in separate insulated cars. Suitably constructed boxes were provided in the working sections for storing explosives and detonators. Coal and rock were blasted on shift with permissible explosives, fired with permissible blasting units by authorized shot firers. Incombustible material was used for stemming, and the shots were fired singly immediately after charging. Tests for gas and examinations of the roof, face, and ribs were made before and after firing each shot. Examinations for fires were made following blasting.

Ventilation and Gases. Ventilation was induced by two fans operating exhausting. The fans were located on the surface in fireproof housings offset more than 15 feet from the nearest side of the mine openings and were equipped with the necessary safety devices. At the time of the last Federal inspection the fans were circulating approximately 536,000 cubic feet of air a minute at a water-gage pressure of 3.8 and 4.9 inches. A split system of ventilation, utilizing overcasts and regulators, was used. The main and secondary haulage roads were in intake air. Permanent stoppings in main and room entries and overcasts were constructed of solid, substantial, incombustible material. Some temporary stoppings were constructed of wood. Line brattice was used where necessary, and where doors were required they were installed in pairs to form air locks. Quantities of air ranging from 10,700 to 36,000 cubic feet a minute were passing through the last open crosscut in each set of entries, and from 15,000 to 23,800 cubic feet of air a minute was being delivered to the intake end of each pillar line at the time of the last Federal inspection.

The mine is classed gassy in accordance with the law of the State, and at the time of the last Federal inspection methane was being liberated at a calculated rate of 1,456,128 cubic feet in 24 hours. Preshift, on-shift, and weekly tests for methane and examinations for other hazards were made. Active bleeders and bleeder entries were provided for all pillars. Considerable methane was liberated during the coal outburst, but due to an adequate ventilating system and the maintenance of active bleeders this condition was corrected promptly. Tests for gas were made with a permissible flame safety lamp in the accessible places in the vicinity of the coal outburst and gas was not detected or an oxygen deficiency indicated.

Dust. The mine ranged from wet to dry, but all sections of the mine were rock-dusted. The working places in the section where the outburst occurred were well rock-dusted to within less than 40 feet of the faces. Coal dust was not permitted to accumulate excessively and coal dust was allayed during normal mining operations by means of water sprays installed on mining and loading machines and at places where shuttle cars discharged the coal into mine cars.

Transportation. Coal was transported from the working faces in mine cars hauled by cable-reel locomotives and in shuttle cars. From the sidetracks, the coal was transported to the surface in mine cars hauled by trolley locomotives. Haulage equipment appeared to be maintained in good operating condition. Track and roadbeds were kept in good condition and the clearance space was kept free of obstructions. Men were transported in regular mine cars, which were handled in a safe manner, and suitable man-trip waiting stations were provided.

Electricity. Electric power was received at 6,900 volts alternating current and was converted to 275 volts direct current for use underground. Trolley and feeder lines were well installed on insulated hangers. Cut-out switches were provided near the beginning of branch lines and at proper intervals along the main lines. The underground pump stations and rectifier sets were installed in well-ventilated fireproof rooms. Electric face equipment, such as mining machines, loading machines, and rock-dusting machines, was of the permissible type and was maintained in permissible condition. Cable-reel locomotives and shuttle cars were of the explosion-tested type. Trailing cables were of the fire-resistant type and were protected against overload. Tests for gas were made at frequent intervals in the face regions where electric equipment was operated.

Illumination and Smoking. All persons underground carried permissible electric cap lamps for portable illumination, and smoking was not permitted in this mine.

Mine Rescue. Fire-fighting equipment was adequate. A fire truck, equipped with 150 feet of hose and two tanks containing 170 gallons of chemicals, was provided underground. Supplies of rock dust and fire extinguishers were located at strategic places throughout the mine, and fire extinguishers were provided on all electric equipment. Water in pipe lines was available throughout the mine. Travelable escapeways were available from the working sections to the surface. A fire-fighting organization was maintained. Mine rescue apparatus was provided at a centrally located station at Gary, McDowell County, West Virginia, and trained personnel was available.

STORY OF COAL OUTBURST AND RECOVERY OPERATIONS

Activities of Bureau of Mines Personnel. Bureau of Mines personnel did not participate in the recovery operations. The outburst occurred about 8:40 p.m., and bodies of the victims had been removed and all persons in the section were accounted for when the Bureau was notified about 11:00 p.m. The Welch office was notified of the outburst by Mr. E. L. Chatfield, inspector-at-large, West Virginia Department of Mines, and this information was immediately forwarded to Mr. E. E. Quenon, Chief, Mount Hope Branch, Accident Prevention and Health Division. An investigation of the scene of the accident was made on February 10, 1953, by Messrs. T. C. Higgins, W. E. Gaylor, and J. L. Gilley. Mr. E. M. Thomas, Chief, Roof-Control Section, Bureau of Mines, arrived on February 11, 1953, and participated in the conference and hearings held on that day.

Story of Outburst. The accident occurred about 8:40 p.m. in a room, which in effect was a pocket, being driven into the remnant of the main entry barrier pillar block situated on the left of the recovery headings between 19 and 20 lefts. This block was the remnant of a barrier pillar originally 160 feet in width and 250 feet in length developed during first mining for protection of main and secondary haulage entries and airways. This barrier pillar had been reduced to approximately 130 by 125 feet in size by driving three places along the inby side parallel to the line of extraction. The place where the accident occurred was started on February 6, 1953, and was being driven from the outby side toward the goaf. The place was 20 feet in width and had been driven to a depth of 35 feet when the outburst occurred.

Employees in the place at the time of the outburst consisted of Fred Hayes, loading-machine operator; Nash Newbill, helper on the loading machine; and Oscar Roberts, shuttle-car operator. It was reported that 14 cars of coal had been loaded by the crew from this place, the shuttle car was servicing the loading machine and was partly loaded with coal, and the other shuttle car used on the section was at the loading ramp and had partially discharged its load when the outburst occurred.

The loading-machine operator and helper were thrown forcibly against the frame of the loading machine and killed instantly. The shuttle-car operator, who was maneuvering the shuttle car during the loading operations, was ejected from the control seat and stunned momentarily. He also received a small laceration over the right eye, apparently caused by a flying object. Lonnie Ball, preparation man, working at the entrance to the place where the outburst occurred, was knocked down and suffered slight concussions. The section foreman and the eight other workmen, locations of whom are indicated on the map shown in Appendix B, felt the tremor of the outburst but were not injured.

Recovery Operations. Recovery operations were started as soon as the dust-laden atmosphere created by the outburst cleared sufficiently to permit visibility. Reportedly, a dense cloud of dust was raised into the

air by the outburst and for several minutes it was impossible to see. Electric power was cut off immediately according to practice and recovery operations were started by the uninjured workmen led by Raymond Castle, section foreman. Oscar Roberts and Lonnie Ball were assisted to the surface and the bodies of the victims were recovered about 10:30 p.m.

INVESTIGATION OF CAUSE OF OUTBURST

Investigation Committee. An investigation of the cause of the outburst was made at the scene of the accident on February 10, 1953, by the following persons:

West Virginia Department of Mines

E. L. Chatfield
W. E. White

Inspector-at-Large
Coal-Mine Inspector

Company Officials

C. R. Pringle
Perry Mosley
Ernest Keiling
William Kelly
Woodrow Davis
John Dorsick
A. J. Burns
John Povlich
G. T. Gillison

Superintendent
Mine Foreman
Section Foreman
Section Foreman
Section Foreman
Section Foreman
Chief Mine Inspector
Mine Inspector
Ventilation Engineer

United Mine Workers of America

John Anderson
Roy Smith
J. C. Blair

Chairman, Mine Safety Committee
Member, Mine Safety Committee
Member, Mine Safety Committee

United States Bureau of Mines

T. C. Higgins
W. E. Gaylor
J. L. Gilley

Coal-Mine Inspector
Coal-Mine Inspector
Coal-Mine Inspector

Witnesses were not available for interview on the date of the underground investigation but they were interviewed on February 11, 1953. After the witnesses had been interviewed on February 11, a conference was held in Mr. W. R. Stedman's office for the purpose of discussing the outburst and devising methods of mining to prevent similar occurrences. The following persons in addition to those named above participated:

Company Officials

W. R. Stedman
W. G. Talman
L. L. Lineberry
George Sambrook
Wayne Snell
Martin Hayduk

General Superintendent
Asst. General Superintendent
Division Superintendent
Safety Director
Asst. Safety Director
Mining Engineer

United Mine Workers of America

C. E. Jones

Safety Director, District 29

United States Bureau of Mines

Edward M. Thomas

Chief, Roof-Control Section

Evidence of Activities. The following information was obtained by an investigation of the scene of the accident and by statements from the following persons: Jewell Freeman, first-shift section foreman; Oscar Roberts, injured shuttle-car operator; H. H. Duncan, loading ramp operator; and John Hope, section foreman who was assisting Jewell Freeman on the section during the first shift.

The statements of the witnesses were essentially the same. Conditions within the affected area appeared to be normal before the accident. Small bumps incidental to pillar extraction in this coal bed had occurred but none indicated that a major outburst was impending. Jewell Freeman, the section foreman, said that the place where the outburst occurred was cut, blasted, and loaded out once during the day shift. It had been cut and blasted toward the end of the shift, but no coal had been loaded out of the second cut during the shift. According to Oscar Roberts, the last shuttle car of coal was being loaded when the outburst occurred. It was intended to remove the loading machine to an adjoining working place so that the affected place could again be prepared for loading.

As noted in Appendix B, the place was being driven toward the goaf and in proximity to a highly stressed core area of the pillar block and this pillar block, originally approximately 40,000 square feet in area, had been reduced by extraction to approximately 15,625 square feet and was much greater in dimensions than the adjacent pillar blocks fringing the line of extraction. These smaller pillar blocks were individually nearly equal in size. It is not unreasonable to assume that this large block became progressively over-stressed with the focus of stress laterally constrained near the center. The stress wave released by the ultimate failure of this coal pillar was rather intense. The forces were concentrated in the room opening and extended laterally and in a diagonal direction through the block to the No. 1 recovery airway (see Appendix B). The forces released in the room were sufficiently intense to shear the loading head and conveyor section from the caterpillar unit of the loading machine and

to thrust the loading machine and the shuttle car forcibly against the left rib of the place. Coal was shaken from the periphery of the block and the outrush of coal was violent within the confines of the working place. It was sufficient to close the No. 8 recovery airway, which was adjacent and parallel to the affected pillar block, for a distance of about 30 feet.

The roof was not shaken down in the affected area, and the mine floor was not affected particularly, except for a distance of 135 feet extending outby the line of extraction in the No. 7 recovery heading. Slight heaving of the floor was present at a few other places near the affected block. One temporary wooden stopping was damaged and two check curtains were dislodged. A dense cloud of dust was reported to have been thrown into suspension by the outburst throughout the passageways adjacent to the affected area and considerable methane was liberated. Ventilation was restored promptly and methane was not detected during the investigation. The section was well rock-dusted at the time of the outburst. All timbers were dislodged in the affected room and a few cross bars and other timbers were knocked down at three locations. Roof bolts, no doubt, prevented the roof from being shaken down at some of the intersections, particularly in the vicinity of the affected block, thereby facilitating recovery operations.

Investigation of the pillar line revealed that extensive caving in the goaf evidently occurred soon following extraction of coal. The roof break line extended reasonably close to the line of extraction, even though the pillar line was irregular with points projecting into the mined-out area, as shown in Appendix B.

Summary of Evidence. A summary of evidence is as follows:

1. A place was being driven in proximity to a highly stressed core of the pillar, directly toward the line of extraction opposing the natural direction of forces, into a large pillar block situated in the abutment zone.
2. The large barrier pillar block was not developed or divided into blocks of equal dimensions to prevent over-stressing.
3. The adjacent pillar blocks, which were nearly equal in size, were much smaller than the affected barrier block, thus permitting concentration of forces on this larger block.
4. The pillar line was irregular with points projecting partly into the goaf.

Cause of Outburst. It was the opinion of the investigators of the United States Bureau of Mines that the cause of the outburst was a combination of existing conditions as follows:

A large coal pillar block was next to the line of extraction and it was flanked on three sides by coal pillars much smaller in size. This large coal pillar had not been developed, prior to its becoming part of the extraction line, comparable in dimensions and shape to surrounding pillar blocks so as to prevent concentration of forces induced by the retreating abutment upon individual pillars. This large coal pillar was partly projecting into the mined-out area, thus accepting the major portion of the load. A room, which in effect was a pillar pocket, was being driven into this large coal pillar, located in the abutment area, directly toward the goaf and in proximity to the stressed core of the pillar.

RECOMMENDATIONS

The following recommendations are submitted in the belief that if followed the number and severity of coal outbursts at this mine will be minimized in the future:

1. Coal pillars should be developed as nearly uniform in dimensions and in shape as practicable and sufficiently in advance (500 feet or more) of the retreating pillar line. In any case, development should be sufficiently in advance of the progressive outward movement of the abutment load so as to minimize concentration of stress on individual pillars.
2. In pillar recovery under hard massive roof which resists caving, every precaution should be taken to extract the coal pillars in a manner that will permit orderly distribution of stresses.
3. Mining projections in the future should be planned to eliminate the practice of having large blocks of coal, which in comparison are much greater in dimensions than surrounding pillars, within the abutment area of the retreating pillar line.
4. The coal pillars should be recovered by the open-end pocket method, and no splitting of pillars or other secondary development should be done within the abutment area. Places should not be driven toward the goaf in highly stressed pillar blocks.
5. Pillars should be extracted in a manner that will not leave major points projecting into the gob.
6. Mining conditions throughout this mine should be examined and practices that could induce outbursts should be eliminated.

APPENDIX A

LIST OF DECEASED AND INJURED MEN

Injured Fatally

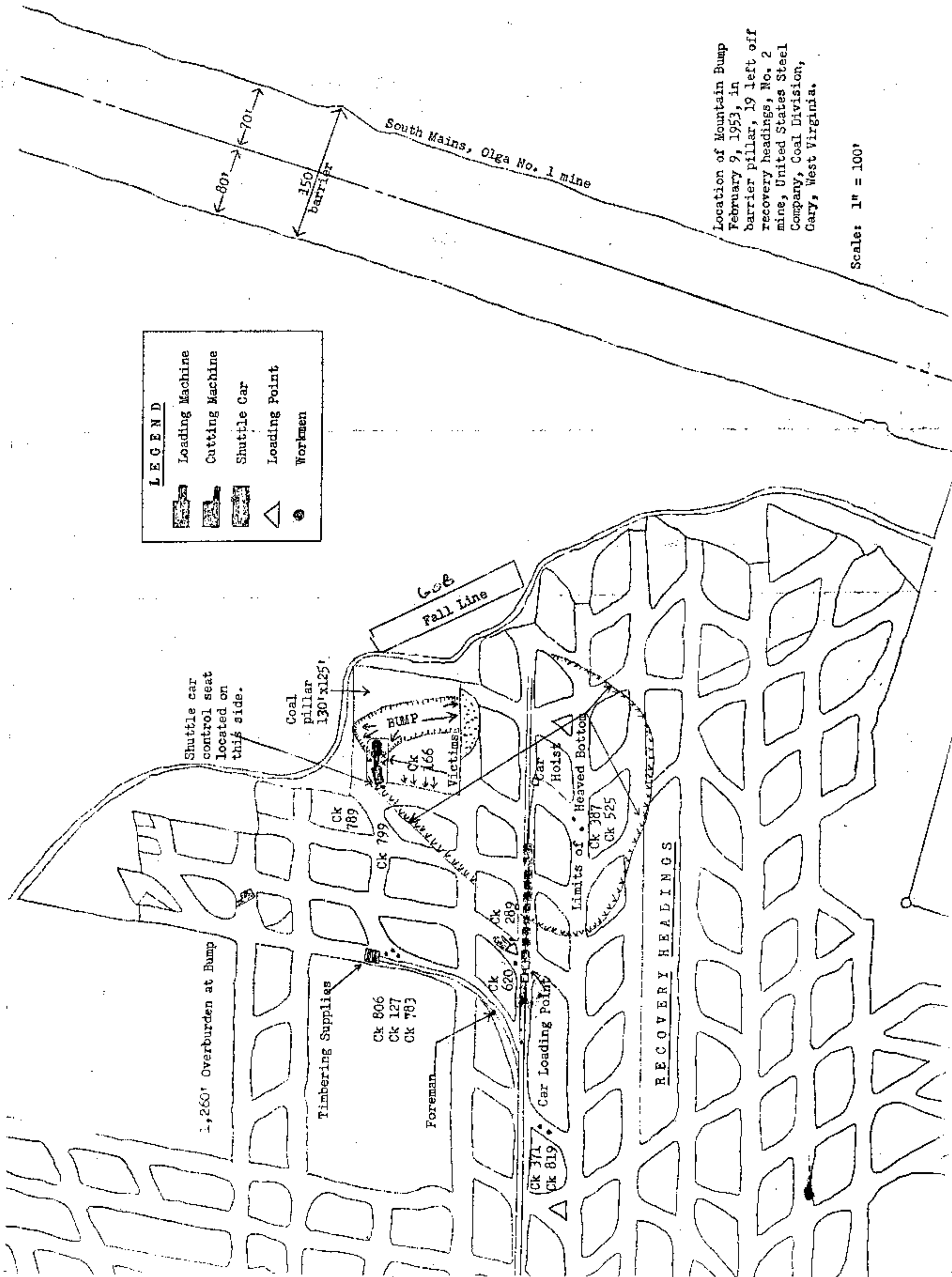
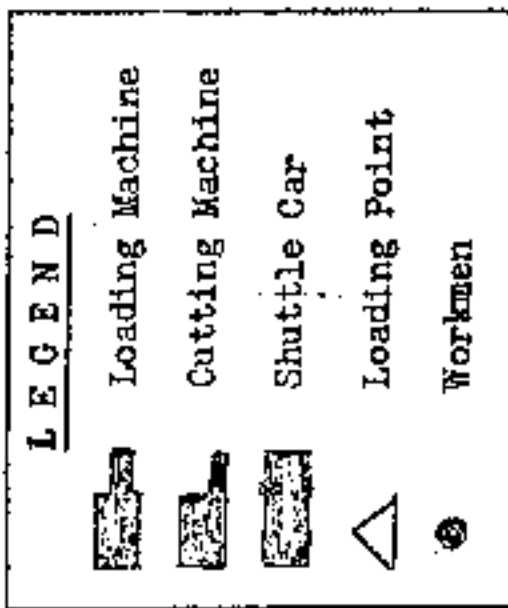
<u>Name</u>	<u>Occupation</u>	<u>Age</u>	<u>Mining Experience</u>	<u>Dependents</u>
Fred Hayes	Loading-Machine Operator	34 years	15 years	Wife and four children
Nash Newbill	Loading-Machine Helper	42 years	24 years	Wife and eight children

Injured Slightly

<u>Name</u>	<u>Occupation</u>	<u>Nature of Injury</u>
Oscar Roberts	Shuttle-Car Operator	Small laceration over right eye; stunned momentarily.
Lonnie Ball	Preparation Man	Slight concussion.

Neither of the injured persons required hospitalization.

APPENDIX B



Location of Mountain Bump
February 9, 1953, in
barrier pillar, 19 left off
recovery headings, No. 2
mine, United States Steel
Company, Coal Division,
Gary, West Virginia.

Scale: 1" = 100'